general relativity – November 24, 2009

material discussed in class

Roughly 5.6 and 5.7 of the book.

exercises

• Consider again the Schwarzschild solution. Someone is at \( t = 0 \) at \( r = 2MG \). Show that no matter what this person does, he or she will always hit the singularity in a proper time \( \Delta \tau \leq \pi MG \).

• Take the Schwarzschild metric and replace \( M \) with a function \( M(r) \) to get

\[
ds^2 = -(1 - \frac{2GM(r)}{r})dt^2 + (1 - \frac{2GM(r)}{r})^{-1}dr^2 + r^2(d\theta^2 + \sin^2 \theta d\phi^2). \tag{1}
\]

Suppose that this is a solution of the Einstein equation for some perfect-fluid energy momentum tensor in comoving coordinates. Compute \( G_{00} \) from (1) and from this \( \rho(r) \).